SCHIZOPOD CRUSTACEANS IN THE U. S. NATIONAL MUSEUM. THE FAMILIES LOPHOGASTRIDÆ AND EUCOPIIDÆ.

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INTRODUCTION.

The paper submitted herewith forms the first installment of a series of articles describing the Schizopod collections in the United States National Museum. It treats of the families Lophogastridæ and Eucopiidæ, which consist almost exclusively of deep-sea forms. The material at hand, chiefly in the genus *Gnathophausia*, is so rich that it has been possible to prepare a complete revision of that genus, and it has been found that some characters, which were regarded hitherto as of specific value, are but differences of age in the same species. This made it necessary to prove the changes of these characters with age, and consequently, the discussion of some of the species is somewhat lengthy.

Other families of the Schizopods will be taken up successively, and the results will be published similarly, as the time at the disposal of the writer will permit.

Family LOPHOGASTRIDÆ G. O. Sars.

1. LOPHOGASTER TYPICUS M. Sars.

Ortmann, Bull. U. S. Fish Comm. for 1903, Pt. 3, 1905, p. 967 (see for complete list of literature).—Stebbing, South African Crustacea, Pt. 2, Cape of Good Hope Dept. Agric. 1902, p. 43.—Holt and Tattersall, Rep. Fisher. Ireland, Pt. 2, Append., IV, 1905, p. 141.

Of this species, material was available from two regions, from which it was not hitherto known, namely, the western Atlantic (coast of United States and Gulf of Mexico), and the western Pacific (Japan).

The specimens from the western Atlantic are divided into three sets: One from the coast of the Carolinas (*Albatross* stations Nos. 2314, 2601, 2602), consisting of together 10 males and 3 females; the second from the Gulf of Mexico (Stations Nos. 2399, 2401, 2403),

together 9 males and 1 female; the third from Key West (*Fish Hawk* stations Nos. 7282, 7283, 7286).

The northern specimens, from the Carolinas, compare with the European (and South African) form in the following particulars:

(1) The rostrum is longer, generally about as long as the peduncle of the antennula, but in two specimens (males) it is shorter than this peduncle, although longer than in the typical form; and in 2 females from Station No. 2602 it is slightly longer than this peduncle but distinctly shorter than the antennal scale.

(2) The antennal scale has on the outer margin a greater number of teeth; the normal number seems to be 6 or 7; five specimens have 6 teeth on both sides; two specimens have 6 on one side, and 7 on the other; one female has 7 teeth on both sides. Besides, there is one specimen with 6 teeth on one side, and three with 7 teeth on one side, while the other side could not be determined owing to its damaged condition. Finally, one female has 6 teeth on the right, and 5 on the left side. Thus 5 to 7 are the numbers found, 5 once, 6 fourteen times, 7 seven times.

(3) In the number of lateral teeth of the telson, these specimens agree well with the European form, the usual number being 3 on each side. There are, however, a few exceptions. Four specimens have 3 teeth on one side, but only 2 on the other; one specimen has 3 teeth on one side and 4 on the other (female, Station No. 2602), and one (male, Station No. 2601), has 1 spine only on each side, placed at a different level, the right one being more proximal than the left one.

Those from the Mexican Gulf have the following characters:

(1) The rostrum is in one case only shorter than the peduncle of the antennula; in seven specimens it is longer than this peduncle, but shorter than the antennal scale; and in one case (Station No. 2399) it is about as long as the antennal scale (in the remaining individual it is damaged). Thus the average slightly exceeds that of the northern set.

(2) The antennal scale has in seven cases 6 teeth on both sides; in one case there are 6 on one, 7 on the other side; and in two cases there are 7 teeth on both sides. This agrees well with the condition found in the northern set.

(3) The telson has uniformly 3 teeth on both sides, with one exception, where there are 2 on the right and 3 on the left. This seems to be the normal condition in Atlantic specimens.

The specimens from Key West (6 males, 2 females), collected by the U. S. Bureau of Fisheries vessel *Fish Hawk*, agree very well with the Gulf form. The rostrum is as long as the peduncle of the antennula, except in two cases, in which it is slightly longer. The antennal scale has generally 6 teeth, but in two specimens there are 7 on the right side. The telson has 3 teeth on each side, but in two specimens there are 2 teeth on one side and 3 on the other.

The largest West Atlantic specimen is a male from Station No. 2401, measuring 29 mm. The few females at hand are all small and measure between 16 and 18 mm.

A series of fifteen specimens, 9 males and 6 females, from six stations off Honshu Island, Japan, was examined. None of them were found to be smaller than 21 mm.; the females were between 21 and 27 mm., and two of them (24 and 27 mm.) were gravid; the males being between 22 and 32 mm. They have the following characters:

(1) The rostrum is comparatively long, even longer than in the West Atlantic form, which in turn exceeds the average found in the Hawaiian. There is not a single individual in which it is shorter than the peduncle of the antennula. In three (2 males and 1 female) it is about as long as this peduncle, while in all others it is distinctly longer. Generally it is shorter than the scale of the antenna, but in a few cases it is of equal length.

(2) The antennal scale has generally only 3 teeth on the outer margin; in one individual (male, 31 mm.) there are 2 on the right and 3 on the left side, and in another one (male, 27 mm.) the reverse is the case. Thus these specimens represent the opposite extreme of that seen in the West Atlantic form. The Hawaiian form is intermediate with 3 to 5 teeth.

(3) The telson generally has 2 spines on the lateral margins on each side. Four specimens, however, constitute an exception, having 1 spine on the right side and 2 on the left.

The above records show that these characters can not be regarded as of specific value. Taking the European and South African form as the type, the West Atlantic specimens agree with them in the spines of the telson, while all the Pacific specimens possess the tendency to reduce their number. The rostrum is shortest in the typical form, but in all others shows a tendency to become longer; the Hawaiian form comes close to the typical in this respect, while both the West Atlantic and the Japanese differ more distinctly. In the number of teeth of the antennal scale the typical form is intermediate (5); the West Atlantic form varies in one direction (6 to 7), while the Pacific varies in the other: the Hawaiian with 3 to 5 teeth is more closely allied to the typical form than the Japanese, which has only 2 or 3 teeth.

It is very likely that intermediate localities, when found, will tend to connect these forms more closely, and it would be interesting to know particulars about these connecting links.

Localities represented in the U. S. National Museum.

FROM U. S. BUREAU OF FISHERIES STEAMER *Albatross* STATIONS.

2314.—4 males. Between Charleston and Savannah, off South Carolina coast; 159 fathoms.
2399.—1 male. Gulf of Mexico; 196 fathoms.
2401.—1 male. Gulf of Mexico; 142 fathoms.
2403.—7 males, 1 female. Gulf of Mexico; 88 fathoms.
2601.—5 males. Between Cape Hatteras and Charleston, off North Carolina coast; 107 fathoms.
2602.—1 male, 2 females. Between Cape Hatteras and Charleston, off North Carolina coast; 124 fathoms.
3707.—1 female. Off Honshu Island, Japan; 63 to 75 fathoms.
3714.—1 male, 1 female. Off Honshu Island, Japan; 48 to 60 fathoms.
3715.—4 males, 1 female. Off Honshu Island, Japan; 68 to 65 fathoms.
3717.—1 male. Off Honshu Island, Japan; 100 to 63 fathoms.
3718.—3 males, 2 females. Off Honshu Island, Japan; 65 fathoms.
3740.—1 female. Off Honshu Island, Japan; 65 fathoms.

FROM U. S. BUREAU OF FISHERIES STEAMER *Fish Hawk* STATIONS.

7232.—4 males, 2 females. Gulf Stream, off Key West; 109 fathoms.
7283.—1 male. Gulf Stream, off Key West; 127 fathoms.
7286.—1 male. Gulf Stream, off Key West; 133 fathoms.

Localities previously recorded.—Norway, Shetland Islands, Ireland, Bay of Biscay, Mediterranean, Cape of Good Hope, 20–300 fathoms; off Cape St. Blaize, South Africa, 40 fathoms; Hawaiian Islands (Pailolo Channel, Molokai and Laysan Islands), at about the same depth.

2. LOPHOGASTER SPINOSUS, new species.

Plate I, figs. 1*a*, 1*b*.

Type.—Cat. No. 11464, U.S.N.M. Female. U. S. Bureau of Fisheries steamer *Albatross* station No. 2666, between Bahamas and Cape Fear, North Carolina. Latitude 30° 47′ 30″ north; longitude 79° 49′ west; depth, 270 fathoms.

Although built in the main according to the pattern of the typical and hitherto only known species of the genus, this species differs from the latter in several well-marked characters.

(1) Rostrum greatly elongated, almost as long as the carapace in the median line. It exceeds the antennal scales, which also are greatly elongated, and it is without teeth or denticulations. It is directed forward, and is almost straight.

(2) Antennal scale greatly elongated and lanceolate; its outer margin is formed by a strong rib, which extends into a long spine; the inner, lamellar part is much shorter, and reaches only to about the distal third of the spine. Outer margin of the spine with 9 spiniform ser-

rations on right side, and with 10 on the left; and, further, there is a similar serration on the inner margin, just above the upper end of the lamellar part, and opposite to the second tooth (counted from the tip) of the outer margin.

(3) Lateral wings of carapace produced posteriorly into a long spine on each side, which is almost one-third as long as the carapace (excluding rostrum).

(4) Sixth abdominal segment with a subdorsal spine directed straight backward on posterior margin, at the base of the telson, on each side.

(5) Telson slightly more elongated than in *L. typicus*, and with five marginal spines on each side. The terminal spines are similar to those of *L. typicus:* two pairs, and between them at the posterior termination a serrated crest, which, however, has only four teeth. (The tip of the telson is not very well preserved in the type, as the two outer, smaller terminal spines are broken off.)

Measurements.—Total length: 39 mm.; length of rostrum (in front of eyes): 8; length of carapace along dorsal line, including rostrum: 19.

GENUS GNATHOPHAUSIA Willemoes-Suhm.

KEY TO THE SPECIES OF GNATHOPHAUSIA:

a. Antennal scale small, not jointed, no strong rib terminating in a spine on outer margin; outer margin serrate. Epimera of sixth abdominal segment united ventrally, forming together a cordiform, concave plate, incised at apex. Dorsal keel of carapace interrupted. Lower lateral keel not curving upward behind, but terminating in a spine at the postero-inferior angle. Branchiostegal lobe generally with a well-developed spine (sometimes obsolete). Maxillipeds with a small exopodite.

b. Both lappets of the epimera of the second to fifth abdominal segment pointed and spiniform. Antennal scale subovate, apex shortly pointed.

c. Rostrum and all spines of carapace comparatively short or obsolete....*ingens*

c′. Rostrum and spines of carapace well developed and comparatively long.....*calcarata* ([a])

b′. Anterior lappet of the epimera of the first to the fifth abdominal segment small, rounded; posterior lappet pointed and spiniform. Antennal scale sublanceolate, tapering to a sharp, spiniform point..*gigas* (+*drepanephora?*)

a′. Antennal scale large, of usual form, jointed at the extremity, outer margin formed by a strong rib terminating in a spine. Epimera of sixth abdominal segment not confluent ventrally.

b. Lower lateral keel of carapace not curving up behind, but terminating in a spine on the postero-inferior angle of the carapace. Median keel of carapace interrupted, with spiniform serrations. Median line of abdominal segments with strong spines. Upper lateral keel of carapace wanting. Two epimeral spines on each side of the anterior section of sixth abdominal segment Maxillipeds with exopodite .....*gracilis*

b′. Lower lateral keel of carapace curving up behind; no spine at postero-inferior angle of carapace. Median keel of carapace not interrupted, without spiniform serrations. Median line of abdominal segments—if armed at all—only with posteriorly projecting, small spines. Upper lateral keel of carapace present, very rarely wanting. Maxillipeds without exopodite.

[a] *G. calcarata* may be the young stage of *G. ingens.*

c. Two epimeral spines on each side of anterior section of sixth abdominal segment. Upper lateral keel of carapace present. Antennal spine obsolete. Branchiostegal lobe with a well-marked, triangular spine. Spine of outer margin of antennal scale projecting considerably beyond terminal lobe, serrated on both margins ..... *longispina*

c'. One epimeral spine on each side of anterior section of sixth abdominal segment. Antennal spine more or less distinct. Branchiostegal lobe without spine, generally rounded, rarely angular. Spine of outer margin of antennal scale not, or only slightly, projecting beyond terminal lobe.

d. Upper lateral keel of carapace present.

e. Abdominal segments dorsally slightly keeled, with small, posteriorly projecting spines. Epimera of five anterior abdominal segments pointed posteriorly. Branchiostegal lobe rounded.

f. Carapace not suddenly constricted anteriorly, and forming no shoulder. Branchiostegal lobes moderately developed ..... *zoëa*

f'. Carapace suddenly constricted anteriorly, forming a distinct shoulder in front of the anterior ends of the upper lateral keels. Branchiostegal lobe greatly expanded ..... *scapularis*

e'. Abdominal segments dorsally not keeled, without spines. Epimera of five anterior abdominal segments rounded posteriorly. Branchiostegal lobe slightly angular ..... *affinis*

d'. Upper lateral keel of carapace wanting. Branchiostegal lobe rounded or angular, but without spine. Abdominal segments dorsally without keel, but posteriorly with a small, depressed, triangular projection. Epimera of five anterior abdominal segments ending in small points posteriorly ..... *elegans*

3. GNATHOPHAUSIA INGENS (Dohrn).

Lophogaster ingens DOHRN, Zeitschr. wiss. Zool., XX, 1870, p. 610, pl. XXXI, figs. 12–14.

Gnathophausia ingens G. O. SARS, Forh. Selsk. Christiania, 1883, No. 3; Rep. Challenger, XIII, 1885, p. 30, pl. II.

I have never seen this species. It is founded upon a very old female, sexually mature, and a similar female has served as the basis for Sars's description. It is very closely allied to *G. calcarata*, and I strongly incline to the opinion that it will prove to be *G. calcarata*, representing an old female of that species, in which case it will be called *G. ingens*, the name *calcarata* becoming a synonym.

G. ingens especially agrees with *G. calcarata* in the following important characters:

(1) General form of body, and arrangement of keels and spines of carapace.

(2) Sculpture and armature of abdomen, especially as the epimera of the five anterior segments are identical in both forms.

(3) Shape of antennal scale.

It differs from *G. calcarata* in the following respects:

(1) In the shorter rostrum and the inferior development of all spines of the carapace, the supraorbital spine being even wanting, the branchiostegal spine being obsolete.

(2) In the absence of the two pairs of oblique keels on the superior face of the carapace.

(3) In the shape of the ventral epimeral plate of the sixth abdominal segment, which, although closely approaching the shape seen in the largest specimens of *G. calcarata*, has the tips separated and bifid, the inner spine being slightly longer.

The first of these characters can not be regarded as of specific value. Dohrn's specimen measured 155 mm., Sars's specimen 157 mm. The largest *G. calcarata* at hand (and ever observed) measures 115 mm., and consequently, is considerably younger than the known specimens of *G. ingens*. Now, as shown below, it is a general rule in this genus that all the spines of the carapace and the rostrum decrease in relative size with advancing age, and thus it is easy to believe that the slight development of these spines in *G. ingens* is due to old age only. In fact, if we imagine that *G. calcarata* grows larger and that the spines decrease proportionally, we would obtain, at about the size of 150 to 160 mm., the conditions found in *G. ingens*.

As to the second differential character, the lack of the two oblique keels on the upper face of the carapace, this may have been overlooked by Dohrn and Sars. In fact, these two keels were overlooked by Sars in *G. calcarata;* at any rate, they are not mentioned in the description, although one of the figures (Plate IV, fig. 2) shows traces of them.

The third character offers only a slight difference from the condition seen in large specimens of *G. calcarata*. In the latter the tips of the epimeral plate of the sixth abdominal segment are in contact in the median line, while in *G. ingens* they are separated, according to Sars's fig. 6 on Plate II. Moreover, in *G. calcarata* the outer spine of the bifid end of each of the tips is greatly longer than the inner, while in *G. ingens* the inner spine is slightly the longer.

At present this last character remains the only one upon which *G. ingens* and *G. calcarata* can be separated, and it is not improbable that further material will demonstrate that one form passes into the other when we consider the changes in the sixth epimeral plate in its development from the young *G. calcarata* to the old.

Distribution of G. ingens.—Off the west coast of Africa: "Laos," depth not recorded (Dohrn). Near Aru Island, Arafura Sea (New Guinea), 800 fathoms (Sars).

4. GNATHOPHAUSIA CALCARATA G. O. Sars.

Plate I, figs. 2*a*, 2*b*.

Gnathophausia calcarata G. O. Sars, Forh. Selsk. Christiania, 1883, No. 5; Rep. Challenger, XIII, 1885, p. 35, pl. IV.—Ortmann, Bull. U. S. Fish Comm. for 1903, Pt. 3, 1905, p. 968.

Gnathophausia bengalensis Wood-Mason, Ann. Nat. Hist. (6), VIII, 1891, p. 269.

Specific characters.—Aside from the group characters (see *a* in the key), the following are to be considered as of specific value:

(1) The subovate, not lanceolate, shape of the antennal scale.

(2) The presence of two pairs of oblique keels on the upper surface of the carapace.

(3) The shape of the epimera of the second to fifth abdominal segment, both lappets of which are pointed and spiniform.

(4) The bifid points of the epimera of the sixth abdominal segment, with the inner point much shorter than the outer (in old specimens only).

Description.—Carapace with dorsal, upper, and lower lateral keels. Dorsal keel interrupted in the middle part. Lower lateral keel ending in a spine at the postero-inferior angle of the carapace. On upper face of carapace, between median and upper lateral keels, there are two oblique keels on each side, converging posteriorly, the anterior pair running toward the anterior end of the posterior section of the dorsal keel, but not joining it; the posterior pair running almost parallel to the first pair, their hind ends not joining the dorsal keel. Rostrum of various lengths, according to age, about as long as the rest of the carapace in very young specimens. In older ones, the part in front of the supraocular spines is about one-third of the length of the rest of the carapace. Supraocular spines very small, sometimes obsolete. Antennal spines small, but well developed, the most constant spines in size. Branchiostegal spines quite large and well developed in young specimens, and longer than the antennal spines. In old specimens they are not only relatively, but absolutely smaller, and become shorter than the antennal spines. Postero-dorsal spine of various lengths, according to age, but the variation is not very great; it is always well developed, but shorter than the postero-inferior spines. Spines of postero-inferior angle greatly varying in length with age; very long, almost half the length of the carapace (excluding the rostrum) in young specimens, and distinctly diverging and spreading out in a postero-lateral direction. In old specimens they are much shorter, even absolutely shorter, and are as short as about one-seventh of the carapace (without rostrum); they are not divergent, but directed straight backward. Branchiostegal, postero dorsal, and postero-inferior spines, when well developed, with more or less distinct serrations, which become indistinct with age, and even disappear entirely.

Antennal scale small, subovate, pointed; point not produced. Outer margin serrate, serrations three to six (sometimes different on right and left sides), the distal serration at a certain distance from the tip of the scale, and the margin between this serration and the tip either straight or slightly emarginate, thus giving a more or less truncate appearance to the scale.

Abdomen sculptured by a distinct transverse groove near the posterior margin of each of the five anterior segments; there is a similar but fainter groove near the anterior margin. The posterior groove is continued down to the epimeral lappets, and here its anterior edge is marked on an elevated ridge. This sculpture is seen clearly only in well-preserved specimens, and sometimes there are traces of a subdorsal longitudinal keel on each side. Also a blunt median keel is sometimes indicated. The epimera of the second to the fifth segment consist of two lappets, which are both produced and acutely pointed, the posterior being somewhat longer than the anterior. The anterior lappet of the first segment is considerably shorter than the spiniform posterior lappet, and is not produced into a spine, but bluntly pointed or even obtuse. The epimera of the sixth abdominal segment unite ventrally to form a concave, cordiform plate, which, in old individuals, is produced beyond the posterior margin of the sixth segment. In young individuals the right and left lappets are short and simply pointed, and separated from one another by a shallow emargination. With increasing age they become much elongated, are separated by a narrow slit, and the tips become bifid, a second point developing on the inner side, which is always much shorter than the outer point. In old individuals the inner tips are in contact in the median line and may even overlap.

Variations with age.—I had an excellent opportunity to study this species, as over 40 individuals in good condition were available, of very different sizes and ages, ranging from 42 mm. to about 115 mm. The three first-named specific characters are always present, but the fourth is observed only in older individuals. The spines of the carapace are very variable in their development according to age, and generally they are comparatively longer in young specimens and shorter in old ones. Sometimes, in the cases of the branchiostegal and postero-inferior spines, even the absolute length in older specimens is inferior to that in younger ones. This seems to be a general rule in this genus, for it was discovered by the writer in another species of the genus, *G. longispina*.[a]

Another important variation, due to age, is found in the ventral epimeral plate (see Plate I, figs. 2*a*–2*f*). The smallest individual (42 mm., Station No. 3627, fig. 2*a*) has this plate very short; the two tips

[a] Bull. U. S. Fish Comm. for 1903, 1905, p. 970.

are simply pointed and widely separated by a shallow and wide incision. With advancing age the tips of this plate are more produced (specimen of 55 mm., Station No. 2980, fig. 2*b*, and specimen of 68 mm., Station No. 2929, fig. 2*c*), a slight angulation appears on the inner side of the tips, which are not so widely separated, the incision becoming narrower and longer. Farther on the tips are gradually produced beyond the posterior margin of the segment (specimen of 81 mm., Station No. 2919, fig. 2*d*, and specimen of 91 mm., Station No. 4389, fig. 2*e*), the inner angle develops into a distinct spine, which is shorter than the tip, and the two tips approach each other closely, finally coming in contact at the level of the smaller inner point. The incision becomes long and narrow, slit-like. In the largest specimen at hand (115 mm., Station No. 3670, fig. 2*f*) the two tips approach so closely to each other that the inner point of the left side overlaps that of the right.

Identity of G. bengalensis with G. calcarata.—Wood-Mason gives the following differential characters for his *G. bengalensis:*

(1) "Carapace covers the whole of the first and part of the second abdominal somite," while in *G. calcarata* the carapace does not cover the trunk entirely.

(2) "The antennal, branchiostegal, and postero-inferior spines appear quite smooth to the naked eye, being only obsoletely or microscopically serrated."

(3) "The supraorbital spine is readily distinguishable by its shape from the rostral denticles."

(4) "The upper lateral keels are strongly roof-shaped."

(5) "The oblique subdorsal keels are more pronounced."

(6) "Antennal scale more broadly emarginate at the apex."

(7) "The pleural lappets of the last abdominal somite are terminated by two very unequal spines (of which the outer is longer and sharp, and the inner short and blunt), and are separated from one another posteriorly in the mid-ventral line by a long and narrow incision."

Length of Wood-Mason's specimen (female with a rudimentary brood-pouch): 91 mm.

Of these characters, the following may be remarked:

(1) It depends entirely on the state of preservation how much of the trunk or the abdomen is covered by the carapace. In my specimens, there are the following limits: The minimum, when only the trunk is covered, the maximum, when the whole of the first and the anterior part of the second abdominal segment is covered. The latter case corresponds to Wood-Mason's species, but, as it happens, this one is found in a small individual (55 mm. Station No. 2384), which is, in all other respects, and especially in the ventral epimeral plate, a typical *calcarata*. In many of my specimens, in which the state of preservation permits, they being rather flabby, I am able at will to change the degree of covering of the abdomen, by simply pulling out or pushing in the latter.

(2) The serrations are to my eyes, which are normal-sighted, always invisible, and I have to use a lens to discover them. Some-

times, chiefly in old individuals, they are actually wanting. Their presence or absence cannot constitute a specific character.

(3) The supraorbital spine is sometimes distinctly visible, sometimes entirely obsolete. If present, it is always marked by its position. Even when developed, it is so small that its presence or absence cannot be of specific value.

(4) What Wood-Mason means by "roof-shaped" upper lateral keels, I cannot imagine.

(5) The oblique dorsal keels are also found in Sars's species; they are slightly indicated in his fig. 2 (chiefly the posterior pair, which is most important). In poorly preserved, flabby specimens, which have undergone much rough handling, they are sometimes indistinct. They are present in all my individuals, and hence this character can not be accepted as constituting a difference between *bengalensis* and *calcarata*.

(6) The degree of emargination or truncation of the antennal scale offers variations, as is already indicated in Sars's figures (Plate IV, figs. 2, 4, 5). I have called attention to this fact in connection with the Hawaiian material[a], which is further confirmed by the present material. A real emargination (*i. e.*, a concave marginal line) is comparatively rare; generally there is a truncation, with the marginal line between tip and first tooth straight.

(7) The description of the epimeral plate given by Wood-Mason corresponds exactly to what we see in my figs. 2*a* to 2*f*, with the exception that the inner tip of each epimeral lappet is sharp, not blunt. In younger specimens, however, it *is* blunt (see my figs. 2*b* and 2*c*). Thus this character agrees well with the assumption that *G. bengalensis* is an older and larger *G. calcarata*.

Thus of the seven characters given by Wood-Mason for *G. bengalensis*, six are not actual differences, and one, the fourth, is unintelligible. The only real difference from Sars's description and figure is found in the epimeral plate of the sixth abdominal segment: but this organ, as shown, changes its form with age, and *G. bengalensis* is a rather large individual (91 mm.). Specimens from my material of the same size present an epimeral plate (see fig. 2*c*) closely corresponding to Wood-Mason's description.

Sars had two specimens of this species; the large one was 98 mm., and to it belong the figures of the whole animal (slightly enlarged, Plate IV, figs. 1, 2). The carapace of the smaller one (68 mm.) is figured in his fig. 3. Sars does not say from which individual the other figures are taken, but it seems from the latter. Then his figure of the epimeral plate (fig. 6) belongs to this smaller individual. The same plate of an individual of the same size (68 mm.) is figured in my

[a] Bull. U. S. Fish Comm. for 1903, 1905, p. 969.

fig. 2*c*, and shows a rather more advanced stage, although it comes very close to Sars's figure, and differs considerably from the epimeral plate of larger specimens. Sars's figure is about intermediate between my figures 2*b* and 2*c*, representing specimens of 55 and 68 mm., respectively.

Sex in G. calcarata.—It is rather hard to distinguish male and female in this genus unless full-grown individuals are at hand. Old females are readily recognized by the presence of marsupial lamellæ at the bases of the thoracic legs. These lamellæ "are absent in the male, but the male has, at the coxa of the last pair of legs, posteriorly and on each side, a small tuberculiform prominence, representing the outer sexual appendage."[a]

In young and not quite adult females, however, the marsupial lamellæ are comparatively small. In all the females of the present species, even the largest, the lamellæ were not fully developed, being short and narrow, not folding over one another in the median line, so that a "marsupial pouch" is not formed. In younger individuals these lamellæ are very small, hardly distinguishable. The smallest in which I found traces of them was 64 mm. long (Station No. 2980). In all smaller specimens there was no trace of them, and I was unable to make out whether they were young males or young females, as the male tubercle is generally not visible; in one individual only (55 mm., Station No. 2980) I thought I could see this tubercle. Upward of the size of about 65 mm. it is possible to tell the males from the females, and it is remarkable that in the material examined females were more abundant, there being only 9 males, as against 23 females. It is remarkable, further, that the largest male was only 76 mm. long, and that all specimens above this size were females (17 of them). Sars's largest specimen of 98 mm. is said to be a male, while Wood-Mason's specimen (91 mm.) was a female.

The fact that even the largest females did not have the marsupial pouch completely developed indicates that they were not fully mature sexually. This makes it probable that they would have to develop further before being able to propagate, and suggests the possibility that they may attain the size of *G. ingens*, in which case they might assume the characters of the latter, thus making *G. ingens* the full-grown female of this species.

Most of the specimens were from the Eastern Pacific (California region), only one young one (55 mm., Station No. 2384) being from the Gulf of Mexico. This is distinguished by a very long rostrum and very long postero-inferior spines. The rostrum, in front of the supra-ocular spines, is slightly longer than the rest of the carapace (excluding the postero-dorsal spine), and was even longer than that, since the

[a] Sars, p. 27, and Plate III, figs. 14 and 15.

tip is damaged. The postero-inferior spines are as long as the distance from their base to the posterior base of the branchiostegal lobe (resembling closely Sars's fig. 3 on Plate IV). (A specimen from Station No. 2980, also 55 mm. long, has the rostrum slightly shorter than the carapace, and the postero-inferior spines are only half as long as in the specimen from the Mexican Gulf.) For the rest, this specimen shows no differences; especially the epimeral plate agrees exactly with the specimen from Station No. 2980, shown in my fig. 2*b*. The carapace covers the anterior part of the second abdominal segment, representing the maximum among my material, but this is probably due to the method of preservation. It has the appearance of having been put into strong alcohol at first, and consequently is much contracted. In slightly younger specimens from California the rostrum is relatively of the same length, and the postero-inferior spines at least approach the condition found in the Gulf specimen.

Localities represented in the U. S. National Museum.

FROM U. S. BUREAU OF FISHERIES STEAMER *Albatross* STATIONS.

2384.—1 young. Gulf of Mexico; 940 fathoms.
2839.—1 male, 1 female. Santa Barbara Islands, California; 414 fathoms.
2919.—1 female. Off southern California; 984 fathoms.
2923.—1 female. Off southern California; 822 fathoms.
2929.—1 male. Off southern California; 623 fathoms.
2936.—1 male, 3 females. Off southern California; 359 fathoms.
2980.—2 males, 1 female. Off southern California; 603 fathoms.
2986.—1 young. Off Lower California; 684 fathoms.
3127.—2 females. Off central California; 62 fathoms.
3348.—1 young. Off northern California; 455 fathoms.
3627.—1 young. West of Cortez and Tanner Banks; 776 fathoms.
3670.—1 female. Monterey Bay; 581 fathoms.
4333.—2 females. Off San Diego; 301 to 487 fathoms.
4334.—1 male, 1 female. Off San Diego; 514 to 541 fathoms.
4335.—1 male. Off San Diego; 500 to 530 fathoms.
4336.—1 male, 1 female. Off San Diego; 518 to 565 fathoms.
4337.—2 males, 1 female. Off San Diego; 617 to 680 fathoms.
4339.—1 female. Off San Diego; 241 to 369 fathoms.
4351.—1 male (?) young, 1 female. Off San Diego; 423 to 488 fathoms
4353.—1 female. Off San Diego; 628 to 640 fathoms.
4354.—2 young. Off San Diego; 646 to 650 fathoms.
4379.—1 female. Off San Diego; 257 to 408 fathoms.
4380.—1 female. Off San Diego; 530 to 618 fathoms.
4381.—1 female. Off San Diego; 618 to 667 fathoms.
4382.—1 female, 1 young. Off San Diego; 642 to 666 fathoms.
4389.—1 male, 3 females. Off San Diego; 608 to 671 fathoms.

4390. 1 female. Off Santa Catalina Islands, 1,350 to 2,182 fathoms.
4528. 1 male. Monterey Bay; 545 to 800 fathoms.

Previous records.—Arafura Sea, 800 fathoms (Sars); vicinity of Talaur Island, S. of Mindanao, Philippines, 500 fathoms (Sars); Hawaiian Islands: Kaiwi Channel, and vicinity of Kauai Island, 442–881 fathoms (Ortmann); Bay of Bengal, 1748 fathoms (Wood-Mason).

5. GNATHOPHAUSIA GIGAS Willemoes-Suhm.

Plate II, figs. 1*b*, 1*a*.

Gnathophausia gigas Willemoes-Suhm, Trans. Linn. Soc. London, Zool. (2), I, 1875, p. 28, pl. IX, figs. 16, 17; pl. X, figs. 2, 3.—G. O. Sars, Forh. Selsk. Christiania, 1883, no. 4; Rep. Challenger, XIII, 1885, p. 33, pl. III.—Ortmann, Bull. U. S. Fish Comm. for 1903, Pt. 3, 1905, p. 968.

This species is closely allied to *G. calcarata*, but differs in certain constant characters. On account of the general resemblance of both species, it is hardly necessary to give a complete description of *G. gigas*, and it will suffice to mention the differential characters.

1. The arrangement of the keels of the carapace is essentially the same in both species, with the exception that the posterior oblique keels of the upper face are entirely wanting in *G. gigas*. The anterior oblique keels are present, occupying the same position as in *G. calcarata*.

2. The spines of the carapace, in young specimens, are about the same as in *G. calcarata*, but the supraocular spine is more distinct, and as large as, or even larger than, the antennal spine. In older individuals all the spines are shorter than in *G. calcarata*, with the exception of the supraocular, which is always distinct. Antennal spine small, branchiostegal generally slightly larger than the latter, postero-dorsal very short. The largest are the postero-inferior spines, which approach closely those of *G. calcarata*, although they are shorter in the average.

3. Antennal scale of *G. gigas* of slightly different shape; it is rather lanceolate, and not ovate, and the terminal point is longer and more tapering. The outer margin has four or five spiniform serrations, the anterior sharp and strong, the posterior small and sometimes obsolete; these serrations, generally, are stronger than in *G. calcarata*.

4. The epimera of the five anterior abdominal segments are different in both species. While in *G. calcarata* both lappets of the second to fifth are strongly developed and are both spiniform, in *G. gigas* only the posterior lappet is produced and spiniform in all five segments, and the anterior is small and rounded (see Sars's fig. 1 on Plate III).

5. The ventral epimeral plate of the sixth abdominal segment differs in both species in the larger individuals. In young specimens of *G.*

gigas (see Plate II, fig. 1*a*, taken from a small individual, 56 mm. long, Station No. 3329), it is rather indifferent in shape, the two tips being widely separated by a very shallow incision; *the two halves are not completely united in the median line.* In larger individuals (see my fig. 1*b* on Plate II, taken from an immature female about 90 mm. long, Station No. 2741) the tips are produced almost to the posterior margin of the segment, are more closely approached, and separated by a narrower and longer incision. This incision, however, is wider than in specimens of corresponding size of *G. calcarata*, and the tips on both sides are simple, not bifid as in *G. calcarata*. However, Sars in his fig. 5 on Plate III draws an accessory terminal spine on the outer side of the left tip, while the right tip is entire. In our specimens I have never seen a condition like this. Our largest individual (Station No. 2860, 119 mm.) has the epimeral plate similar to that shown in our fig. 1*b* on Plate II, but it is slightly shorter and the outer margin is more evenly rounded, not angular, as in the latter.

The characters given under 1, 3, and 4 are most important, and according to my experience always hold good. Characters 2 and 5 are not so reliable, although they may prove to be of some help. With regard to the relative length of the rostrum and the spines of the carapace, again the fact will have to be stated that they all are comparatively longer in young specimens, as I have already pointed out. The epimeral plate of the sixth abdominal segment, although different from that of *G. calcarata*, is not very reliable on account of the marked changes in shape taking place during development.

Our largest specimen (Station No. 2860) is 119 mm. long; and is a female with the marsupial pouch fully developed. Sars's specimen was a male, 142 mm. long. Our second largest individual (Station No. 2741) is an immature female about 90 mm. long, with small, but distinct marsupial lamellæ, which do not form a "pouch." All other specimens that have come under my observation are much smaller; the one from Hawaii is 50 mm., another from Sitka Sound, Alaska, (to be described elsewhere) is 55 mm. long, and the present young one from Station No. 3329 is 56 mm. long. They have no traces of marsupial lamellæ, and have been regarded by me as males. But I am not quite sure as to this point. They may be young females. The two specimens from Station No. 3340 consist of two badly damaged carapaces with remnants of the trunk, while in both the abdomen is entirely missing. However, they undoubtedly belong to this species, since characters 1 and 3 are clearly observable.

Localities represented in the U. S. National Museum.

FROM U. S. BUREAU OF FISHERIES STEAMER *Albatross* STATIONS.

2741.—1 female adult. Between Cape Charles and Long Island; 852 fathoms.

2860.—1 female. Between Sitka and Columbia River; 876 fathoms.

3329.—1 young. Bering Sea; 399 fathoms.

3340.—2 specimens (damaged). Between Unalaska and Kadiak; 695 fathoms.

Previous records.—West of Azores, 2,200 fathoms (Sars); Hawaiian Islands, vicinity of Kauai Island; 850–767 fathoms (Ortmann).

Another locality is off Sitka Sound, Alaska, 922 fathoms.

6. GNATHOPHAUSIA DREPANEPHORA Holt and Tattersall.

Gnathophausia drepanephora HOLT and TATTERSALL, Rep. Fisheries Ireland, Pt. 2, Append. No. 4, 1905, p. 113, pl. XVIII; Ann. Nat. Hist. (7), XVI, 1905, p. 9, pl. II.

I have not seen this species, but I strongly suspect that it is only the young stage of *G. gigas*.

Holt and Tattersall create for it a separate section of the genus, uniting characters of the two main divisions; it agrees in every respect with our first division (*a* of the key), with the exception that the epimera of the sixth abdominal segment are said to be not united ventrally.

Disregarding the latter character, *G. drepanephora* agrees in every particular with *G. gigas*, making allowance for the much less advanced age of the former (only 39 mm.); thus the spines of the carapace, chiefly the postero-dorsal and the postero-laterals are much more developed relatively. Further, in *G. drepanephora*, the epimera of the five anterior abdominal segments are described and figured as possessing only a posterior lappet, which is produced and spiniform while the anterior lappet is absent. This also may be due to age.

As regards the epimera of the sixth abdominal segment, Holt and Tattersall describe them as not united ventrally. We have seen above, under *G. gigas*, that in young individuals (56 mm. long) these parts are not completely united in the median line, and thus it appears possible that *G. drepanephora* represents only a stage that is younger yet than the youngest known specimen of *G. gigas*.

Lack of material of the young of *G. gigas* prevents the settlement of this question finally, but I am inclined to regard *G. drepanephora* as the young stage of *G. gigas*.

G. drepanephora has been found off the western coast of Ireland, latitude 52° 27′ 06″ north; longitude 15° 40′ west, in 1,770 fathoms.

7. GNATHOPHAUSIA GRACILIS Willemoes-Suhm.

Gnathophausia gracilis Willemoes-Suhm, Trans. Linn. Soc. London (2) 1, 1875, p. 33, pl. IX, fig. 1.—G. O. Sars, Forh. Selsk. Christiania, 1883, no. 11; Rep. Challenger, XIII, 1885, p. 48, pl. VII, figs. 6–10.

Gnathophausia gracilis var. *brevispinis* Wood-Mason and Alcock, Ann. Nat. Hist. (6), VII, 1891, p. 188.

Gnathophausia brevispinis Wood-Mason and Alcock, Ann. Nat. Hist. (6), VII, 1891, p. 269.—Faxon, Mem. Mus. Comp. Zool., XVIII, 1895, p. 216, pl. J.

Gnathophausia dentata Faxon, Bull. Mus. Comp. Zool., XXIV, 1893, p. 217.[a]

Carapace with keels and spines of the type of the first group, but upper lateral keel entirely absent. Lower lateral keel terminating in a spine at the postero-inferior angle of the carapace. There is another smaller spine just below this one, which is directed outward and sometimes obsolete. Median keel interrupted, its posterior part with spiniform serrations. Postero-dorsal spine short. From the anterior end of the posterior part of the dorsal keel a pair of oblique keels runs forward and downward. Anterior part of dorsal keel triangularly elevated upon the gastric region, forming a prominent dentate crest, which extends forward to the rostrum. Supraocular spines small; antennal spines larger; branchiostegal spines very large.

Antennal scale of the type of the second group, large, of usual shape, formed by a lanceolate-ovate lamella, the outer margin of which has a strong spine, which is serrated at the outer edge and projects slightly beyond the terminal lobe of the lamellar part.

Abdomen of the general type of the second group, but peculiar on account of the great development of dorsal spines. The first and second segments have each 2 large, triangular spines in the median line, the posterior of them at the posterior margin of the segment; the anterior spine of the first segment is generally smaller than the posterior. The following 3 segments (third to fifth) have each a posteriorly projecting spine on the posterior dorsal end. The two lappets of the epimera of the first to the fifth segments are short and pointed, the posterior slightly longer than the anterior.

Epimera of the sixth abdominal segment of the type of the second group, not united ventrally to form a ventral plate. There are 2 triangular, pointed epimeral lappets on each side of the anterior part of the sixth segment.

I do not entertain the slightest doubt that *G. brevispinis* Wood-Mason and Alcock, is identical with *G. gracilis* Suhm. Faxon[b] admits the following differences of *G. brevispinis* from *G. gracilis:*

1. Prominent, dentate gastric crest.

[a] The *Gnathophausia* figured on the colored plate opposite p. 500 in Chun, Aus den Tiefen des Weltmeeres, 1900, resembles this species, except for the spine just back of the cervical groove.

[b] Mem. Mus. Comp. Zool., XVIII, 1895, p. 218.

2. Small size (or even absence) of the lower spine of the postero-inferior angle of the carapace.

3. Great breadth of the antennal scale.

4. Pleura of first 4 abdominal segments expanded posteriorly.

5. A transverse fold separating the 2 dorsal spines of the second abdominal segment.

I have to make the following remarks as to these points:

1. According to Willemoes-Suhm, the gastric region of *G. gracilis* has 2 small teeth in the median line; according to Sars, who examined the same individual, it is unarmed. This difference is apparently due to the poor state of preservation of the *Challenger* specimen, and, as Sars's figure is probably inaccurate in this respect, we can not depend on this character.

2. The lower spine of the postero-inferior angle of the carapace is certainly subject to variation. Faxon says that it is sometimes nearly or quite obsolete; my specimen, which agrees in most respects with *G. brevispinis*, has it well developed, although smaller than the upper spine and not quite so large as in Sars's figure. Consequently this character is not reliable.

In the width of the antennal scale I fail to observe any difference between Sars's (Plate VII, fig. 8) and Faxon's (Plate J, fig. 1*c*) figures. In the latter, it may be slightly wider in the basal part, but this does not constitute a specific difference.

As to 4 and 5 we can not compare *G. brevispinis* with *G. gracilis*, as Sars does not mention these characters. His figures, indeed, do not show the features given for *G. brevispinis*, but it must be borne in mind that this may be due to the poor condition of the *Challenger* specimen. My specimen agrees with *G. brevispinis* in these respects.

The very peculiar association of characters found in both of these species (which are supposed to be distinct) on account of which it is necessary to place them by themselves within the genus, renders it probable, from the start, that they are identical. The above considerations remove any probable necessity for their separation, and hence I have no hesitation in uniting them in one species.

The size of Sars's specimen is 41 mm.; of Wood-Mason and Alcock's 82 and 92 mm.; Faxon gives 60 mm. My specimen is about 60 mm. long, and seems to be a male, since no traces of marsupial lamellæ are present. This species seems to attain a larger size, since the largest specimen known (92 mm.) was an "immature female with the last pair of incubatory lamellæ only 3 mm. long" (Wood-Mason).

Locality.—U. S. Bureau of Fisheries steamer *Albatross* station 3128—1 male. Off Central California; 627 fathoms.

Previous records.—Atlantic, between Africa and Brazil, latitude 1° 22′ north, longitude 26° 36′ west, 1,500 fathoms (Sars); Bay of Bengal, 920–690 fathoms and 1,748 fathoms (Wood-Mason and

Alcock); off Panama, 1,201 and 1,471 fathoms (Faxon); off Galapagos Islands, 551, 1,189, and 1,322 fathoms (Faxon).

If the specimen figured by Chun[a] is this species, we have to add: Gulf of Guinea, 4,000 metèrs.

8. GNATHOPHAUSIA LONGISPINA G. O. Sars.

Gnathophausia longispina G. O. Sars, Forh. Selsk. Christiania, 1883 no. 10; Rep. Challenger, XIII, 1885, p. 46, pl. VII, figs. 1-5; pl. VIII.—Ortmann, Bull. U. S. Fish Comm. for 1903, Pt. 3, 1905, p. 969.

This species is not represented in the present material, but I had quite a number of specimens when I worked on the Hawaiian material, and thus I am able to give a good account of it.

Carapace with keels of the type of the second group: An upper lateral keel is present; the lower lateral keel curves up behind, and runs toward the postero-dorsal spine. The dorsal keel is continuous, and projects as a long postero-dorsal spine. Rostrum long. Supraocular spines well developed; antennal spine obsolete (very small or even absent); branchiostegal spine well marked and triangular. No postero-inferior spines, but posterior angles of carapace rounded off. (With the exception of the branchiostegal spine, the spines of the carapace are of the type of the second group.)

Antennal scale of the type of the second group, and remarkably long; the marginal spine is greatly produced, projecting considerably beyond the terminal lobe of the lamellar part, and serrated at both the inner and outer margins.

Abdomen of the type of the second group, with a small posteriorly projecting dorsal spine at the hind margin of each of the five anterior segments. Epimera of the five anterior segments with the two lappets acute, the anterior short and small, the posterior longer and spiniform; in the male, the posterior lappet of the second segment is greatly elongated, with a long spiniform tip; in the female, it does not differ essentially from those of the other segments.

Epimera of sixth abdominal segment of the type of the second group, but there are two triangular, acute lappets on each side, as in *G. gracilis*.

The chief specific characters are: The presence of a branchiostegal spine, the shape of the antennal scale, and the character of the abdominal segments. The remarkable posterior lappet of the second abdominal segment is found only in the male sex, and thus males and females may be easily distinguished.

As I have demonstrated with the help of Hawaiian material, the rostrum, the dorsal and branchiostegal spines, and the marginal serrations of the antennal scale change with age, being more strongly developed in young individuals.

[a] Aus den Tiefen des Weltmeeres, 1900, p. 500.

Size.—Sars had 5 specimens, the largest being a male, 59 mm. long. My material from the Hawaiian Islands consisted of 40 specimens, the largest of which was a female, 62 mm. long, with the marsupial pouch fully developed. Since there were other females, in which at about the size of 50 mm. the marsupial lamellæ were well formed, it is probable that this species does not attain the gigantic dimensions seen in others.

Distribution. Off Samboangan, Philippines, 250 fathoms (Sars). Not rare at the Hawaiian Islands (found at 15 stations), near the islands of Oahu, Molokai, and in Kaiwi Channel, 222–498 fathoms (Ortmann).

9. GNATHOPHAUSIA ZOËA Willemoes-Suhm.

Plate II, fig. 2*a*, 2*b*.

Gnathophausia zoëa Willemoes-Suhm, Nature, VIII, 1873, p. 401, fig. 6; Trans. Linn. Soc. London (2), I, 1875, p. 32, pl. xix, figs. 2–15; pl. x, fig. 4.—A. Milne-Edwards, Rec. fig. Crust. nouv., I, 1883.—G. O. Sars, Rep. Chall., XIII, 1885, p. 44, pl. vi, figs. 6–10.—Faxon, Mem. Mus. Comp. Zool, XVIII, 1895, p. 215.—Caullery, Ann. Univ. Lyon, fasc. 2, 1896, p. 368.—Alcock and Anderson, Ann. Nat. Hist. (7), III, 1899, p. 3.—Holt and Tattersall, Rep. Fisheries Ireland, II, App. 4, 1905, p. 141.—Hansen, Bull. Mus. Monaco, XXX, 1905, p. 5.

Gnathophausia willemoesi G. O. Sars, Forh. Selsk. Christiania, 1883, no. 6; Rep. Challenger, XIII, 1885, p. 38, pl. v, figs. 1–6.—Faxon, Mem. Mus. Comp. Zool., XVIII, 1895, p. 215, pl. k, fig. 1.—Ortmann, Bull. U. S. Fish. Comm. for 1903, Pt. 3, 1905, p. 969.

10. GNATHOPHAUSIA ZOËA SARSI (Wood-Mason).

Gnathophausia sarsi Wood-Mason, Ann. Nat. Hist. (6), VII, 1891, p. 187.—Ortmann, Bull. U. S. Fish. Comm. for 1903, Pt. 3, 1905, p. 969.

The following are the characters of the species:

Carapace with keels and spines of the type of the second group: upper lateral keel present; lower lateral keel curved up behind; dorsal keel continuous. Rostrum, according to age, longer or shorter. Dorsal spine long in the young; shorter in the old. Supraocular and antennal spines well developed; branchiostegal spine absent, and branchiostegal lobe rounded. No postero-inferior spines, but postero-inferior angle of carapace rounded off or (in the variety) rectangular, forming a narrow laminar expansion behind the marginal rim, which also curves upward. The carapace is not suddenly constricted in the anterior part.

Antennal scale of the type of the second group: large, spine of outer margin projecting slightly beyond the terminal lobe of lamellar part in the young, slightly shorter than the latter in the old. Outer margin of spine slightly serrated in the young, smooth in the old.

Abdomen of the type of the second group: the five anterior segments dorsally indistinctly keeled, and produced into small spines at

the posterior margin. Epimera of the five anterior segments, with the anterior lappet small, the posterior produced and acutely pointed. There is, on each segment, an indistinct subdorsal keel on each side.

Epimera of sixth abdominal segment of the type of the second group, formed by only one triangular, acute lappet on each side of the anterior section of the segment, and not forming a ventral plate.

The only difference of the variety *sarsi* from the typical form is found in the shape of the lamellar expansion of the postero-inferior angle of the carapace: in the typical form, this expansion is rounded off, while in the variety it is rectangular. It is possible that the latter character is only restricted to the young, and that it generally disappears with advancing age, but then it would disappear at different stages in different individuals, in the average, when they are about half grown (see below).

The identity of G. zoëa and G. willemoesi.—I have devoted much time to the study of the differential characters of these two species, as determined by Sars (1885), and have the following to say with reference to them:

In Sars's synopsis of the species (p. 29), the length of the postero-dorsal spine is paramount: it is "greatly produced" in *G. zoëa*, and "comparatively short" in *G. willemoesi*.

The differences between the species, taken from Sars's diagnosis and description (pp. 38 and 44) are the following:

1. The length of the postero-dorsal spine just mentioned: in *G. zoëa* this spine reaches sometimes beyond the fourth abdominal segment, while in *G. willemoesi* it is only slightly longer than the first abdominal segment.

2. The posterior margin of the carapace, and the margins of the postero-dorsal spine are "coarsely denticulate" in *G. zoëa*, and "decidedly glabrous" in *G. willemoesi*.

3. The rostrum is very elongate (even exceeding the carapace without posterior spine), and strongly denticulate in *G. zoëa;* it is shorter than the carapace, and provided with small, comparatively few, denticles in *G. willemoesi*.

4. The spine of the antennal scale projects somewhat beyond the terminal lobe of the lamellar part, and is slightly denticulate at the outer edge, in *G. zoëa;* it is a little shorter than the terminal lobe, and not denticulate, in *G. willemoesi*.

Discussing these four points in detail:

1. Sars seems to lay much stress upon this character. I have shown, however, in several of the foregoing species, that the relative length of the spines of the carapace changes with age, being generally longer in young individuals. As regards the present case, *G. zoëa* is founded upon specimens much younger than those of *G. willemoesi*. Moreover, I have extracted embryos from the marsupial pouch of a large

specimen (from Station No. 2723, about 105 mm. long), which undoubtedly belongs to *G. willemoesi* according to Sars's conception, and these young ones (Plate II, fig. 2*a*) have the postero-dorsal spine well developed, and comparatively much longer than any specimens ever described, extending to about the middle of the telson. Thus the length of the postero-dorsal spine depends without question on the age of the individual.

2. The denticulations or serrations of the posterior margin of the carapace, the postero-dorsal spine, the spines of anterior margin of carapace, and of the rostrum are generally in this genus more distinct in younger individuals than in older ones. I have called attention to this above (under *G. calcarata*). In the present case the large individual from Station No. 2723, which is surely *G. willemoesi*, has the margin of the carapace not "decidedly glabrous," as Sars states, but there are a number of fine denticulations, less distinct than in young individuals, but easily seen. Faxon (1895) says that in *G. willemoesi* there are denticulations along the margin of the dorsal spine. Thus this character does not hold.

3. That the relative length of the rostrum, like that of the spines of the carapace, changes with age is now well established. In the young specimens extracted from the pouch of the mother, the rostrum is decidedly longer than the carapace (Plate II, fig. 2*a*). If the rostrum becomes shorter with age it is not astonishing that the denticulations become less pronounced, and this is entirely in keeping with what I have shown in the second character. Thus the length of the rostrum does not possess any systematic value.

4. The fourth character needs special attention, but I think I am able to prove that it also is influenced by age. In young specimens the spine of the outer margin of the antennal scale is longer than the terminal lobe, and it is slightly serrated on the outer edge. With increasing age it becomes slightly shorter than the terminal lobe, and the serrations disappear. The following may be said in support of this view:

a. The specimens representing the original *G. zoëa* are small or of medium size (not longer than 70 mm.), while the specimens upon which *G. willemoesi* was founded are very large, one measuring 136 mm., and the other being "somewhat smaller;" that is to say, they were about double the size of *G. zoëa*.

b. A large specimen (Station No. 2723) is about 105 mm. long, and has the antennal scale of *G. willemoesi;* another (Station No. 4306) is 88 mm. long, and has the antennal scale intermediate between *G. zoëa* and *willemoesi;* the spine is about as long as the lamellar portion on the left side and very slightly longer than the latter on the right side, and it has on the outer margin very indistinct indications of serrations, visible only under the microscope. *The latter specimen is*

also intermediate with regard to the characters 1, 2, and 3. Younger individuals among the material examined by the writer possess invariably the antennal scale of *G. zoëa*, but it must be added that the serrations of the outer margin are very fine. I can not see them with the naked eye, and an ordinary magnifying lens scarcely shows traces of them, but stronger instruments reveal them distinctly as sharp points for quite a distance along the margin of the spine.

c. Young specimens extracted from the marsupium of a typical *G. willemoesi* have an antennal scale, which, in shape, is that of *G. zoëa*, the marginal spine being longer than the lamellar portion. However, I could not ascertain the presence of serrations on the margin. Under the microscope, there is a kind of undulation of the margin, but no sharp, spiniform teeth. But this is not astonishing, since it is in keeping with the fact, that the serrations or denticulations of rostrum and postero-dorsal spine are not present in these embryonic individuals, while they are well developed in young specimens after they have left the marsupium.

d. Similar changes in the length of the spine of the antennal scale, due to age, have been found in another species, *G. longispina*.

Thus, I think, the assumption well supported, that the characters given for *G. zoëa* are only such as are due to the immaturity of the specimens, and that those assigned to *G. willemoesi* belong to the older stages of the same species. The name of *G. zoëa* has the priority over *G. willemoesi*.

G. sarsi.—For *G. sarsi*, the following differences from *G. willemoesi* are given by Wood-Mason[a].

1. The dorsal spine reaches to the posterior end of the third abdominal segment.

2. "Extreme edge (of carapace) expanded at the postero-inferior angle into a conspicuous rectangular lamina, into which neither its lower lateral keel nor its raised rim enters."

3. Upper half of the posterior margin of the carapace on each side and the lateral edges of the dorsal spine are minutely denticulated.

4. Five anterior abdominal segments with two subdorsal keels.

5. The telson is tricarinate, having a fine median carina, and "appears to be more produced at the tip than in any other species."

The following remarks are to be made:

1. As I have already shown, the length of the dorsal spine can be disregarded; in the present case, the length agrees well with the size of Wood-Mason's specimen; in the typical *G. zoëa*, not longer than 70 mm., it reaches beyond the fourth abdominal segment or falls short of it; in *G. sarsi* (75 mm.) it reaches to the end of the third segment; in one of our specimens, 88 mm. long, it reaches to the middle of the third segment; in another, about 105 mm. long, to the middle of the

[a] Ann. Nat. Hist. (6), VII, 1891, p. 187.

second; and in the type of *G. willemoesi*, 136 mm. long, slightly beyond the first segment. In the larva before leaving the marsupium, as has been said, it reaches to the middle of the telson, and thus the length of this spine entirely depends upon age.

2. The second is the most important character of *G. sarsi*, and I find it in all the younger individuals at hand. The lower lateral keel, and also the marginal keel or rim, curve upward near the postero-inferior angle of the carapace; but the actual margin of the carapace extends behind the point, where the marginal rim begins to curve up, and runs for a short distance straight back; then it forms a right angle, extending toward the dorsal spine. Thus there is, behind the marginal rim, a "rectangular lamina" as described by Wood-Mason.

Sars does not mention such a structure, neither in *G. willemoesi* nor in *G. zoëa*, he only says that the lower lateral keel curves upward before reaching the postero-inferior corner, and that the latter, in *G. willemoesi*, is evenly rounded off. He does not mention the fact, that the marginal rim curves upward before reaching the posterior margin, and that there is a "lamina" behind the marginal rim. Such a lamina, however, is distinctly seen in Sars's figures of *G. willemoesi* and *zoëa* (Plate V, fig. 1, and Plate VI, fig. 6). This is the more important, and clearly establishes the presence of this lamina in Sars's specimens, although he did not pay much attention to this feature, he gave a fair representation of it in the figures. The lamina, however, in both cases, is not rectangular, but evenly rounded off.

Looking at the specimens at hand, I find that the largest, a typical *willemoesi*, represents this character as described and figured by Sars, only the lamina is somewhat wider than in his figure; but it is evenly rounded off. Exactly the same condition obtains in our second largest individual, 88 mm. long. From the Hawaiian Islands I have mentioned two specimens of *G. willemoesi*, which I identified chiefly according to this character, which measure 73 and 52 mm. The largest individual observed by myself among the Hawaiian material, possessed a rectangular lamina, and consequently was recorded under *G. sarsi*. It measured 62 mm. The smallest measured 34 mm.

Considering that Wood-Mason's *G. sarsi* was 75 mm. long, and that Sars's specimens of *G. zoëa*, which have apparently a rounded lamina, were 70 mm. and less, the conclusion is reached that all specimens hitherto observed that are over 75 mm. long, have this character developed according to the *willemoesi* type; all specimens smaller than 52 mm. have it corresponding to the *sarsi* type; specimens between 52 and 75 mm. may possess either a rectangular or a rounded lamina.

But it can not be said positively that this character is due only to age. It may be that the rectangular lamina becomes rounded with advancing age, and that this transition takes place at a different period in different individuals, in the average, when they are about half grown

(50 to 70 mm.). But I am not quite sure of it, and so I prefer, for the present, to regard *G. sarsi* as a variety of *G. zoëa* (= *willemoesi*). It should be mentioned that Faxon[a] thinks that *G. sarsi* is "a form probably not specifically distinct from *G. willemoesi*."

The young specimens extracted from the pouch of the old female show a distinct angle or point behind on each side of the carapace, but as the carapace is rather shapeless, being represented by a kind of a bag filled partly with oily or fatty substance (yolk), it is impossible to correlate these two small points with the infero-posterior corners of the carapace, although this correlation is very probable.

3. I have shown that the denticulation of the posterior margin of the carapace and of the dorsal spine does not constitute a specific character.

4. The subdorsal keels of the abdomen, mentioned by Wood-Mason, are present in all specimens at hand. They are formed by rather faint, blunt elevations, and I should not call them keels. They are easily overlooked, especially in poorly preserved material.

5. A third, fine median keel of the telson is distinctly seen in Sars's illustration of the telson of *G. willemoesi* (Plate V, fig. 6), and is present in all specimens examined by myself. On closer examination I find that this median keel is rather a fine double keel.

Wood-Mason's sentence that the telson "appears to be more produced at the tip than in any other species" is, as I have already remarked in the report on the Hawaiian Schizopods, unintelligible to me. I do not see any difference from other species in the shape of the telson.

Localities represented in the U. S. National Museum.

FROM U. S. BUREAU OF FISHERIES STEAMER *Albatross* STATIONS.

GNATHOPHAUSIA ZOEA.

2723—1 female (gravid). Between Nantucket and Cape Charles, 1,685 fathoms.

4306—1 male. Off San Diego, California, 207–497 fathoms.

GNATHOPHAUSIA ZOEA SARSI.

2351—1 young. Between Havana and Yucatan; 426 fathoms.

Previous records.

Typical form, as G. zoëa: West of Azores, 1,000 fathoms (Sars); Tropical Atlantic, 1° 47′ North, 24° 23′ West, 1,850 fathoms (Sars); off Brazil, 770 fathoms (Sars); Pacific, north of Kermadec Island, 600 fathoms (Sars); off Galapagos Islands, 384 and 581 fathoms (Faxon);

[a] Mem. Mus. Comp. Zool., XVIII, 1895, p. 215.

Bay of Biscay, 800–1,200 meters (A. Milne-Edwards and Caullery); west coast of Ireland, 382–600 fathoms (Holt and Tattersall); Azores, 1,000 meters (Hansen); near Maldive Islands, 430 fathoms (Alcock and Anderson). *Typical form, as G. willemoesi:* Banda Sea, 1,425 fathoms (Sars); Gulf of Panama, 1,270 fathoms (Faxon); off Acapulco, 493–664 fathoms (Faxon); Tres Marias Islands, 680 fathoms (Faxon); Hawaiian Islands, Molokai and Hawaii, 552–809 fathoms (Ortmann).

G. zoëa sarsi: Bay of Bengal, 840 fathoms (Wood-Mason); Hawaiian Islands, vicinity of Kauai and Modu Manu, 293–800 fathoms (Ortmann).

THE LARVAL FORM OF GNATHOPHAUSIA ZOËA.

As previously mentioned, among the material is a large female of this species, representing Sars's form *G. willemoesi*, which has the marsupial pouch fully developed and filled with larvæ. Since larval stages of this genus have never been described, indeed, since nothing is known about the development, with the exception that on account of the presence of a marsupial pouch and in analogy to *Lophogaster* it is presumed that the development of the young form probably reaches a very advanced stage before it leaves the mother, it is advisable to give here a more detailed account of these young specimens.

The number of the young is 21, a remarkably small number, but agreeing well with what we know about the number of the progeny of deep-sea animals. They are all uniformly developed and represent a very advanced stage, in fact, they are no longer embryos, but have left the egg completely. Probably they were about ready to leave the pouch of the mother, as all parts of the body had attained, in a general way, the condition found in the free swimming form.

Within the pouch the young Gnathophausiæ are so arranged that they lie firmly packed together, the head of each directed toward the posterior end and the sternum of the mother, and the tail toward the anterior end of the mother, each overlapping in part the individual in front of it. That is to say, the heads are directed toward the bases, the tails toward the tips of the marsupial lamellæ. The dorsal face of the larvæ is concave, the ventral face convex, corresponding to the curvature of the lamellæ, since the back is turned toward the sternum of the mother, the ventral side toward the enveloping lamellæ.

In each of the young ones (see Plate II, fig. 2*a*) the body is distinctly divided into an anterior (thoracic) and posterior part, which forms a distinctly and completely segmented abdomen. The carapace is represented by a bag-like excrescence, which is provided with distinct and long rostral and postero-dorsal spines. It is filled with the remnant of the yolk. Its keels are very indistinct, but there is a small point posteriorly on each side, possibly representing the postero-inferior corners of the carapace. The dorsal spine is long and closely

appressed to the back of the abdomen, and reaches as far as the middle of the telson. The rostrum is very long, longer than the carapace. It is bent down and appressed toward the ventral side, and directed backward. Neither rostrum nor dorsal spine show any serrations.

All appendages, except the eyes, are closely appressed to the ventral face of the body and are directed backward. In my figure they are not drawn in the natural position, but are slightly spread out and removed from the ventral side in order to show them more distinctly.

The eyes are well developed and of yellowish color. All other appendages resemble more or less those of the adult form, with the general exception that the hairs and bristles are absent or less developed and with the following special exceptions (compare Sars's Plate VIII):

The marginal spine of the antennal scale is longer than the laminar part and has no serrations on the outer margin.

The second maxilla possesses an additional joint at the end of the distal portion of the endognath (called "palp" by Sars, see his fig. 7[p] on Plate VIII). This joint is very small, only about one-fifth as long as the preceding joint (the terminal one in the adult) and less than half as wide. (In the adult it seems to be fused with the penultimate joint, as is indicated by the shape of this joint in Sars's figure.) The "pigmented basal protuberance" (or luminous organ) is indicated in the larva.

The maxilliped resembles Sars's figure (Plate VIII, fig. 8) and also has no exopodite, as is characteristic of the second group of the genus (excepting *G. gracilis*), but it is more slender, the third of the five free joints being not enlarged and about half as wide as in the adult *G. longispina*.

The gills are vestigial and less complex than in the adults.

The tip of the telson has not yet assumed the shape of the adult form (see Plate II, fig. 2*b*). It is not terminated by two strongly-curved spines forming an "almost semilunar" projection, but is terminated by a cordiform or, rather, reniform plate, which carries on each side a larger and a smaller spine and is finely denticulate at the posterior border. The marginal spines of the telson are more uniform than in the adult form, only a few smaller spines being found between the larger ones.

It appears that these larvæ come very near to the adult form, only the carapace remaining what might be called "embryonal" in shape. From the presence of a marsupial pouch it was to be expected that the young reach a high stage of development before being set free and dismissed from the mother's protection. As it happens this has been fully confirmed by the present study, the young contained in the pouch of the mother having passed completely through all embry-

onal stages, and through almost all larval stages; they seem to be ready to leave the marsupium, for it is clear that they need only to stretch out their appendages in order to be able to use them for free swimming.

11. GNATHOPHAUSIA SCAPULARIS, new species.

Plate II, fig. 3*a*–3*c*.

Type and cotype.—U. S. National Museum, 2 males, U. S. Bureau of Fisheries steamer *Albatross*, Station No. 2992, Revillagigedo Islands, Lower California; 460 fathoms. Cat. No. 32327.

Near *G. zoëa*, but easily recognized by the anterior constriction of the carapace and the greatly expanded branchiostegal lobes.

Shape of body rather stout. Carapace covering almost completely the first abdominal segment. Postero-dorsal spine indistinctly denticulate toward posterior margin of carapace, rather short, projecting to about the middle of the second abdominal segment. Rostrum short, much shorter than carapace, denticulate. Supraocular spines strong. Antennal spines small, but distinct. Branchiostegal spines wanting. All keels of carapace well developed. Median keel uninterrupted. Upper lateral keels strong, curved, including a lanceolate, almost plane upper face of the carapace, widest anteriorly. Anterior ends of upper lateral keels strongly curved downward. In front of the anterior ends of these keels the carapace is suddenly constricted and depressed, thus forming a very marked shoulder on each side. This constriction affects greatly the course of the lower lateral keels, which suddenly begin to converge at a point just above the branchiostegal lobes. Above this point and below the anterior end of the upper lateral keel there is an almost pit-like depression, which sends a slight groove upward, toward the median keel. For the rest, the lower lateral keel is similar to that of *G. zoëa*, curving up behind toward the postero-dorsal spine. It projects, however, in its whole length, considerably beyond the keel of the lower margin of the carapace. Thus the whole carapace becomes rather prismatic, almost hexangular, the upper face being flat, but interrupted by the dorsal keel, and the lower surface being wanting (between the two lower margins); compare the cross section of the carapace, Plate II, fig. 3*c*.

Branchiostegal lobes rounded, vault-shaped, and greatly expanded, rendering the carapace at this point as wide as in the middle, in spite of the great constriction above the branchiostegal lobes.

Abdomen very similar to that of *G. zoëa*, practically identical with it. Five anterior segments slightly keeled dorsally, with a small, posteriorly projecting spine at the hind margin. On each side a blunt subdorsal keel. Epimera with the anterior lappet small and rounded or slightly angular; the posterior lappet produced into a sharp spine.

There is a small spine at the base of the basal joint of the pleopods (as in *G. zoëa*). Only one epimeral spine on each side of anterior section of sixth abdominal segment.

All other parts are similar to the corresponding parts of *G. zoëa*, but the antennal scale has the marginal spine considerably shorter than the terminal lobe, without serrations on the outer edge.

This very remarkable species is so closely allied to *G. zoëa* that I should have taken the peculiar conformation of the carapace, caused by the constriction of its anterior part, for a monstrosity, were it not for the fact that two individuals are at hand. The comparatively short spine of the antennal scale possibly constitutes another specific character; in specimens of *G. zoëa* of the same size it is longer than the terminal lobe.

Both specimens are apparently males, since no traces of marsupial lamellæ are visible, and the coxopodite of the last pair of thoracic legs has, posteriorly, a small tubercle, which undoubtedly represents the male orifice.

Measurements of the types.—Total length of larger individual, 75 mm.; length from tip of rostrum to tip of posterior spine of carapace, 46 mm. Total length of smaller individual, about 70 mm., but exact figures can not be given, since the rostrum is broken off near the base.

12. GNATHOPHAUSIA AFFINIS G. O. Sars.

Gnathophausia affinis G. O. Sars, Forh. Selsk. Christiania, 1883, no. 7; Rep. Challenger, XIII, 1885, p. 41, pl. v, figs. 7–10.

I have never seen this species. It is very closely allied to *G. zoëa*, and differs only in the following points:

1. Supraocular and antennal spines smaller, the latter almost obsolete. Branchiostegal lobe slightly angular, but having no spine.

2. Abdominal segments not keeled above, and possessing no dorsal projections or spines on the hind margin.

3. Posterior lappet of the epimera of the five anterior abdominal segments rounded, not spiniform.

Distribution: Only one specimen, a female, of this species is known up to the present time, the one taken by the *Challenger* in the tropical Atlantic Ocean, midway between Africa and Brazil (latitude 1° 22′ north, longitude 23° 36′ west), in 1,500 fathoms. It measured 81 mm.

13. GNATHOPHAUSIA ELEGANS G. O. Sars.

Gnathophausia elegans G. O. Sars, Rep. Challenger, XIII, 1885, p. 42, pl. vi, figs. 1–5.

Carapace with keels and spines of the type of the second group, but upper lateral keel absent. Lower lateral keel curving up behind and much farther distant from the marginal rim than in *G. zoëa*. Dorsal

keel continuous. Rostrum and dorsal spine comparatively long. Supraocular spine well developed. Antennal spine very small, almost obsolete. Branchiostegal lobe rounded or angular, but without spine. No postero-inferior spines. Marginal rim following closely the margin and leaving no laminar expansion at the postero-inferior corner. Carapace not constricted in anterior part.

Antennal scale of the type of the second group and very similar to that of the young *G. zoëa;* it is large, and the spine on the outer margin is slightly longer than the laminar portion. The outer edge with very minute serrations in young specimens, smooth in older ones.

Abdomen of the type of the second group, at least in the young, but the five anterior segments without median keel, although with short, flattened, spiniform projections at posterior dorsal margin. In older individuals these dorsal projections are wanting. Epimera of all abdominal segments similar to those of *G. zoëa.*

The young specimen at hand differs from Sars's original description in the following particulars:

1. The carapace completely covers the trunk.
2. The rostrum and the postero-dorsal spine are longer.
3. Branchiostegal lobe not rounded, but angular.
4. Five anterior abdominal segments with flattened median posterior projection.
5. Spine of antennal scale finely serrated on outer margin.

The first, second, and fifth characters are of no consequence, since similar variations are found in other species, and are plainly due to state of preservation or to age. Our specimen is young, 48 mm. long, while Sars's was 56 mm.

The angular (triangular) shape of the branchiostegal lobe (third character) differs markedly from what is seen in Sars's species, and the presence of flattened spines on the posterior margins of the abdominal segments (fourth character) might also be of importance. Since the present specimen is only the second individual of this species ever reported, I am not prepared to say whether these two characters are of specific or varietal value, or whether they simply constitute additional variations of age. Further material is necessary to decide this question.

Locality.—U. S. Bureau of Fisheries steamer *Albatross* Station No. 3697, 1 young; off Honshu Island, Japan; 265 to 120 fathoms.

Previous record.—South of Fiji Islands, 610 fathoms (Sars).

Family EUCOPIIDÆ G. O. Sars.

14. EUCOPIA AUSTRALIS Dana.

Eucopia australis Dana, U. S. Expl. Exp. Crust., 1852, p. 609, pl. XL, fig. 10.—Hansen, Bull. Mus. Monaco, XLII, 1905, p. 6.

The species of this genus have been largely confounded, as has been pointed out by Hansen. The following specimens all agree with *E. australis* Dana, as reidentified by that author. All my specimens are in poor state of preservation, but the eyes are present in all of them.

The distribution of this form can not be made out satisfactorily until the older material has been reexamined. It is known from the Antarctic Ocean (Dana, Hansen), and the present localities are of interest, since they extend the range into the northern Pacific and tropical Atlantic oceans.

Localities represented in the U. S. National Museum.

FROM U. S. BUREAU OF FISHERIES STEAMER *Albatross* STATIONS.

2751.—1 young. Lesser Antilles, latitude 16° 54′ north; longitude 63° 12′ west; 687 fathoms.

3308.—6 specimens (3 female, 3 young). Bering Sea, latitude 56° 12′ north; longitude 172° 07′ west; 1,625 fathoms.

3604.—1 male. Bering Sea, latitude 54° 54′ north; longitude 168° 59′ west; 1,401 fathoms.

3696.—1 young. Off Honshu Island, Japan; 501 to 749 fathoms.

3783.—1 female. Off Kamchatka; 1,567 fathoms.

4397.—1 young. Off Santa Catalina Islands, California; 2,196 to 2,228 fathoms.

4403.—2 females, 1 young. Off San Clemente Island, California; 505 to 599 fathoms.

15. EUCOPIA UNGUICULATA Willemoes-Suhm.

Eucopia unguiculata Hansen, Bull. Mus. Monaco, XLII, 1905, p. 3.

A single individual, female, about 30 mm. long, belongs to this species. It is rather well preserved, and the characters pointed out by Hansen for this species are present.

Locality.—The U. S. Bureau of Fisheries steamer *Albatross* Station No. 4383, 1 female. Off North Coronado Island, California; 287 to 395 fathoms.

Found previously in the Atlantic Ocean and East Indian Archipelago (Hansen).

EXPLANATION OF FIGURES.

PLATE I.

Fig. 1*a*. *Lophogaster spinosus*, new species. Type from U. S. Bureau of Fisheries steamer *Albatross* Station No. 2666. View from above, 2/1.

Fig. 1*b*. The same. Lateral view of carapace, 2/1.

Fig. 2*a*. *Gnathophausia calcarata* Sars. Epimeral plate of sixth abdominal segment of a specimen, 42 mm. long, from Station No. 3627, about 4/1.

Fig. 2*b*. The same, of a specimen, 55 mm. long, from Station No. 2980, about 4/1.

Fig. 2*c*. The same, of a specimen, 68 mm. long, from Station No. 2929, about 4/1.

Fig. 2*d*. The same, of a specimen, 81 mm. long, from Station No. 2919, about 3/1.

Fig. 2*e*. The same, of a specimen, 91 mm. long, from Station No. 4389, about 3/1.

Fig. 2*f*. The same, of a specimen, 115 mm. long, from Station No. 3670, about 3/1.

PLATE II.

Fig. 1*a*. *Gnathophausia gigas* Suhm. Epimeral plate of sixth abdominal segment of a specimen, 56 mm. long, from Station No. 3329, about 4/1.

Fig. 1*b*. The same, of a specimen, about 90 mm. long, from Station No. 2741, about 3/1.

Fig. 2*a*. *Gnathophausia zoëa* Suhm. Larva, extracted from marsupium of mother, from Station No. 2723. Side view, about 3/1.

Fig. 2*b*. The same, end of telson, greatly enlarged.

Fig. 3*a*. *Gnathophausia scapularis*, new species. Type, from Station No. 2992. Lateral view of body, natural size.

Fig. 3*b*. The same. Upper view of carapace.

Fig. 3*c*. The same. Diagrammatic cross section of carapace at the level of the line A–B in fig. 3*b*.